DOCUMENT RESUME

ED 339 584 RC 018 434

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TITLE Interactive Distance Learning in Connecticut.
PUB DATE 1 Dec 91
NOTE 16p.
PUB TYPE Reports - Descriptive (141)

EDRS PRICE MF01/PC01 Plus Postage.
DESCRIPTORS *Cable Franchising; Cable Television; *Costs; *Distance Education; *Educational Technology; Elementary Secondary Education; *Interactive Video; Program Evaluation; Program Implementation; Rural Schools; School Districts; *Telecourses
IDENTIFIERS *Connecticut; Middlesex Distance Learning Consortium CT

ABSTRACT

This paper provides an overview of distance learning activities in Connecticut and addresses the feasibility of such activities. Distance education programs have evolved from the one dimensional electronic mail systems to the use of sophisticated digital fiber networks. The Middlesex Distance Learning Consortium has developed a long-range plan to link five towns with fiber optic networks. This linkage would provide a completely interactive system in sharing courses among schools. Currently, 3 cable operators of the 27 licensed franchises are operating distance education programs. Each cable television company is responsible for maintaining all outside distributions, while the participating schools are responsible for maintaining the equipment relating to program origination. In some cases, the cable company has decided against becoming involved, citing non-standard installations that render costs prohibitive. The costs of distance education, as a key issue in the process, is being debated in public hearings on cable television franchise renewals before the State Department of Public Utility Control. It is proposed that distance education will continue throughout the 1990's to be used to fill teacher shortages, address declining enrollments, and to ensure educational quality in the midst of school budget constraints. This paper includes approximately 30 citations, a listing of the cost of distance learning classroom equipment and a suggested schedule of payment, a map of current and projected distance learning projects between communities, and a diagram of an interactive distance learning classroom. (LP)

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ED339584

Interactive Distance Learning in Connecticut

A Paper Presented to the Educational Resources
Clearinghouse on Rural Education
and Small Schools

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December 1, 1991

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RC018434

Distance learning is an educational process whereby courses are taught in one site and students participate in a different location.1 Distance learning has been an integral part of the educational scene in many parts of the country and is an attempt to contend with such educational problems as isolated communities, low population densities, and declining enrollments. The purpose of this paper is to provide a brief overview of distance learning activities in general and in Connecticut specifically. The paper will also survey the involvement of Connecticut cable television companies in the provisioning of distance learning services throughout the state.

Distance learning in the United States received its legislative impetus when the United States Congress passed Public Law 100-297 in September, 1988, which created the Star Schools Program. Approximately $19.1 million became available to fund four demonstration distance learning projects designed to expand educational opportunities in rural or isolated school systems throughout the United States.2 Another $30 million was appropriated by Congress for distance learning in October, 1990. Although begun primarily as an adjunct to rural and geographically isolated systems in the less populous states, information age technologies will likely spread distance learning to the more urban areas in the 1990s. The Star Schools Program has allotted nearly $63 million for distance education programs in some 47 states.3 Sponsored by Senator Edward M. Kennedy, who had become concerned that American students were falling behind in in math, science, and foreign language achievement, the Star Schools Bill may result in the launching of a educationally dedicated satellite by the end of this century.4

The antecedents of distance education may be linked with the correspondence-based courses that have been extant since the seventeenth century.5 Currently, distance education programs consist of a diversity of media ranging from electronic text mail delivery to satellite or microwave delivered instruction, and emerging interactive, full-motion instructional video programming.6 Distance education programs have evolved from the one-dimensional electronic mail systems to the use of digital fiber networks. These networks combine the digital video signal with video, voice, or facsimile signals. They can then be carried on the same fiber optic cable, which also functions as a multiplexor.7

Telecommunications equipment manufacturers and technology suppliers, such as Northern Telecom, have begun to institute a new technology-based "Socratic Method" in which the conventional didactic educational paradigm has undergone a type of postmodernist transformation of co-existing technologies.8 Rural school systems have begun to avail themselves of the differing paradigms. These distance education initiatives have been constructed apart from the Star Schools legislative directive. The "Mississippi 2000" distance education model, for instance, uses a fiber optic network and video terminal equipment to configure a local area network (LAN) throughout the rural school districts of Mississippi. This configuration will be the first in the country to employ a switched broadband network with a fiber optic transmission medium to circumvent the need for dedicated cable links among the participating classrooms. Oklahoma's Panhandle Shar-Ed Video Network (PSVN) is the country's first fiber optic, fully interactive educational network.9 The Panhandle system efficiently transmits as much as 565 megabits of information per second. It is designed to become an educational nexus for five states-Texas, New Mexico, Colorado and Kansas in addition to the panhandle area. In Jaunary, 1991, Northwestern Oklahoma State University began using the network.10 A distance learning pilot program in North Carolina called LIFE-Learning is ForEver-is scheduled to be implemented over the next two years. It will use two interactive fiber optic video networks to link participating North Carolina universities, junior colleges, and public schools.

The federal government is involved in distance learning, but the states and municipalities are also major players. Texas, for instance, has developed an interactive video network with the capability of providing audio and two-way video among geographically dispersed classrooms. New York state has had a distance learning network on line since 1985, and Maine plans to connect its seven state university campuses with a fiber optic backbone capable of providing transmission for three channels of bi-directional video, audio, and data.11 The Augusta campus will be a nexus for the statewide satellite network reaching all secondary schools, government buildings, cable television companies, and hospitals throughout the state. The cost for this endeavor will most likely exceed $65 million.

Distance education is not limited to secondary and higher education, although that is where the primary activity has so far occurred. Nevada, for example, has begun a distance learning program in early childhood special education called **Networc.** 12 (Nevada Educational Television Working Out in Rural Communities) The program uses interactive audio and video sessions between instructor and students at various remote sites via the university teleconferencing system. Rural training facilitiators guide students through the curricular activities at each site, and students can interact with one another across sites.

Other distance education programs have been directed toward at-risk student populations. A Memphis, Tennessee, based distance tutoring program called Apple Classroom of Tomorrow (ACOT) is a collaborative effort of Apple Computer, Inc., and the Memphis school system.13 The student base is 100 per cent inner city minority. Each student is assigned a Master's Degree candidate at the Memphis State University for a tutor. The tutor uses an electronic bulletin board system accessed by a modem to leave assignments and to write messages. Each student is provided a computer to use in school and one at home for unrestricted access.

A key question in any distance education model is who will pay.14 Video signal compression technology is emerging as the means by which distance education can be made affordable and cost-effective.15 In Kansas for instance, compression gear is being supplied to a dozen sites throughout the state's interactive video network backbone. According to telecommunications specialist Larry Ehlers, organizations using conferencing services over the Kansas T-1 backbone network cost between $75 and $100 per hour to use. Ehlers states: "That's pretty aggressive pricing. And if you were to use U S Sprint's Meeting Channel, it could cost $180 per hours."16

In Connecticut, the question of distance education costs is currently being hotly debated in public hearings on cable television franchise renewals currently before the State Department of Public Utility Control. (DPUC) Distance education equipment costs have been quantified by some cable television companies and are presented in Table A. One Connecticut cable company estimated the total cost for one distance course as ranging from $6500 to $9500 for 180 days of remote instruction.17

The Middlesex Connecticut, Distance Learning Consortium has developed a long-range plan to link five Connecticut towns with fiber optic networks. Consortium Executive Director Kathleen Barillari, has worked with the local exchange carrier, the Southern New England Telephone Company, and the local cable television operator, Comcast Cablevision, to facilitate the installation of a fiber optic link between the North Haven and Hamden High Schools.18 The status of various Connecticut distance learning projects is presented in Table B. The Middlesex Distance Learning Consortium encompasses the towns of Cromwell, East Hampton, Portland, and Regional School District 13. It was formed in 1982 for the purpose of sharing courses among member high schools that were facing an approximate 11 percent enrollment decline as projected from 1984 through 1990.19 The Consortium works closely with the Valley Shore Telecommunications Cooperative and Regional School District 17, whose distance learning committee is directed by Media Technologist Constance Bombaci. Ms. Barillari and Ms. Bombaci both advocate the planning of a distance learning system that is completely interactive. Various delivery systems have been discussed, including fiber optic cable, but the cable operator has not yet committed to providing distance learning.

While transmission and delivery systems differ, all Consortium-directed projects will use an overhead camera to project visual material, have one camera focused on the teacher, and one camera focused on the students. As Ms. Barillari and Ms. Bombaci note, each remote site classroom is equipped so that instruction can be provided from any of the interactive locations.20 A schematic of a Consortium distance learning classroom is presented in Table C. The goal of the Consortium is to create a bi-directional statewide network facilitiating the offering of fully interactive videotext teleconferencing over the extant cable operator's system. No one particular school would be able to provide such an offering by itself because of budgetary constaints. Ms. Barillari notes that Connecticut General Statute Section 16-333(h) orders each cable operator to extend its services to all primary and secondary schools within its franchise area.21 The Consortium has requested the cable operator increase its channel capacity to allow interactive transmission among its four secondary schools via a planned fiber optic backbone.

Presently in Connecticut three cable operators of the extant 27 licensed franchises have operational distance education programs. Continental Cablevision of Western New England has a distance program called Cable in the Classroom.22 The Company uses return paths to capture and transmit the signals sent by the schools to the Company's centralized transmission site. Two cable channels are used to distribute the signals, while the instructor channel uses one channel and the three other schools make use of a videoplex machine to share a second channel. Cox Cable of Greater Hartford has provided six schools in its franchise area with interactive distance education capability. The company uses a return bandwidth to transmit signals to various central transmission sites. The schools purchased and are responsible for all the internal equipment while the company maintains the equipment outside the school buildings. Lastly, Cablevision of Southern Connecticut provides seven towns in its franchise area with bi-directional, interactive capability through different trunk lines. The system allows for interactivity to occur between two schools in the Westport area, and for schools in the towns of Wilton and Weston. The town of Stamford is scheduled to be provided with interactive capability in the near future.

In each of the above cited cases, the cable television company is responsible for maintaining all outside distribution plant, while the participating schools are responsible for maintaining the equipment relating to program origination. Two other Connecticut cable television operators, United Artists of Plainville, and Comcast Cablevision of Danbury, Inc., are planning to provide return lines to permit the eventual provision of interactive distance education programs.

In some cases, the cable company has decided against becoming involved in distance education projects because of non-standard installations, which in the franchisee's opinion, may render the costs prohibitive. An operator may cite perceived lack of interest as a mitigating factor as well. Comcast Cablevision of Middletown, for example, cites prohibitive costs in implementing a distance protocol. The company stated in a recent franchise renewal before the DPUC that to install return lines from all Consortium high schools to create an interconnection with a nearby regional high school was too costly.

In this instance, the company argued that up-front costs including return lines, terminals, and video origination and production equipment would cost at least $250,000.00 and would likely exceed $500,000.00 to completely configure the system.23 The company further cited expensive operating costs because of the system's geographical complexity.23 Additionally, the operator stated that the development of a franchise-wide interactive configuration would require several non-standard installations which in the Company's opinion, are the responsibility of each school and would also include the difference between the standard and non-standard installation fees. Comcast of Middletown also stated during the course of its franchise renewal proceeding that the cost of one connection to Cromwell High School was $4,000.00. Installation costs of return lines from Cromwell, Portland, East Hampton, and Coginchaug High Schools the Company estimated being at least $125,000.000.24

Connecticut cable television companies have approached distance learning cautiously and with fiscal restraint. As Comcast of Middletown witnesses testified during the public hearings on the issue of distance education, "...it is premature to determine what, if any, contributions the company could or should make in providing bi-directional capabilities among Consortium schools."25 It is evident that distance education programs in Connecticut and elsewhere do not come cheaply, as is shown in Table A. Storer Comunications of Clinton, Inc., stated during its franchise renewal proceeding a "realistic" figure of approximately $1.25 to $1.50 average cost per student per cable transportation mile.26 The company also voiced concern regarding class periods students might miss when travelling to a remote site.

Despite drawbacks however, distance education is beneficial as a means of connecting teachers and students intra and interstate, in getting qualified teachers into rural areas, and to overcome the geographical distances and anamolies between villages, towns, and cities. It is estimated that by 1995, all rural areas in the United States will have some form of distance education network, be it microwave, coaxial, or fiber optic cable.27 Distance education will likely spread from rural to urbanized areas throughout the 1990s, particularly as American agriculture shifts from a labor to capital-intensive paradigm.

Distance learning can offer new and exciting ways of connecting disconnected schools and their students in the learners' own communities.28 Distance education will continue throughout the 1990s to be used to fill teacher shortages, as a strategy to contend with declining enrollments, and to ensure the preservation of pedagogic quality in the face of austerity and concomitant school budget squeezes. Video signal compression techniques, though still somewhat costly, will continue to drive down the price of providing a distance education program. Fiber optics systems are cheaper than digital systems because expensive conversion equipment to convert signals from analog to digital and back are not needed with fiber. As can be seen in the example of Connecticut, state government is and will continue to be a prime mover in the development, funding, and implementing of distance education programs. These programs can be paid from a school district's annual operating budget, from the state, or from the federal government, as in the case of the Star Schools Program. Private sector funds may also be made available. Costs may run from a few thousand dollars for a satellite dish to perhaps $14,000.00 for a bi-directional, fully interactive satellite instructional program.29 Although Connecticut has not yet mandated specific distance education facilities for its more rural schools, it has begun to develop and use distance learning so that these smaller school districts can share facilities with other schools or social service agencies.30 As pointed out by the Middlesex Distance Learning Consortium,

> Once the interactive video system is operational, there are a multitude of additional projected uses including training for staff, fire and police departments, informational town programs, adult education (programs) that will make the system important for more than just the school population of each town...Some (school) districts' populations are increasing. This (distance learning) effort will afford us the opportunity to add some unique offerings that may be staffed in one school district and not another, such as Chinese or Astronomy.31.

As video signal compression technology facilitates transmission of a smaller video signals over standard digital networks, coverage ranges and channel capacities will continue to be increased, and educational resources can be shared. In many cases in Connecticut, transmission lines are already in place thus providing more opportunities for distance education to occur.32 Technologies using digital fiber optics will continue to enhance the dissemination of distance education and provide "homework hotlines" in which students receive homework assistance via a voice messaging system in which the caller may be connected to a tutor in the necessary academic subject.33 Once classrooms are wired for telephone service, they then acquire connectivity to the public switched network and to other schools within the district, to other cities, states, or even countries.

Although Connecticut does not yet have in operation a distance learning system that uses a switched broadband network across digital fiber cable, that time is fast approaching. Groups such as the Middlesex Consortium together with the Valley Shore Telecommunications Cooperative continue to work with the Connecticut Department of Public Utility Control, the local cable television service providers, and the local exchange carrier to establish bi-directional transmission capabilities by the installation of cable television return lines. Equipment necessary to compress and decompress digital video signals is still somewhat expensive, but figures to become more affordable as the technology and concomitant economies of scale develop.34 Look for distance education to spread throughout the state with the assistance of the technologists during the current decade.

NOTES

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10 Bill Teague, "Head of the Class," Connections, 57129.20, (May, 1991): 8-11.

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"Linking Classrooms in Five Connecticut Towns with Fiber Optics," Middlesex Distance Learning Consortium, Durham, CT., June, 1987, pp. 1-18.

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Connecticut Department of Public Utility Control, Comcast Cablevision of Middletown, Inc., Franchise Renewal Proceeding, New Britain, CT.: Docket No. 89-06-33, September 1, 1991.

20
Middlesex Distance Learning Consortium, June, 1987, p. 8.

21
General Statutes of Connecticut, Section 16-333(h), Revised to January 1, 1991, Hartford, CT.: pp. 545-546.

22
Connecticut Department of Public Utility Control, Comcast Cablevision of Middletown, Inc., Franchise Renewal Proceeding, Late-Filed Exhibit No. 11, New Britain, CT.: Docket No. 89-06-33, September 26, 1990.

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Comcast Cablevision of Middletown Inc., Franchise Renewal Proceeding, Docket No. 89-06-33, Exhibit MC-1-MC-7, October 15, 1990, pp. 1-5.

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Ibid., p. 4.

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Ibid., p. 5.

26
Storer Communications of Clinton, Inc., Franchise Renewal Proceeding, Docket No. 90-06-23, Late-Filed Exhibit 1, April 2, 1991.

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Francine E. Jefferson and O. K. Moore, "Distance Education: A Review of Progress and Prospects," Educational Technology, 30, (9), (September, 1990): p. 8.

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Bob Cole, "Teaching in a Time Machine: The "Make-Do" Mentality in Small-Town Schools," Phi Delta Kappan, 70, (2), (October, 1988): pp.139 -144.

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Nancy Kober, "Think Rural Means Isolated?: Not When Distance Learning Reaches Into Schools," The School Administrator, 10, (47), (November, 1990): p. 17.

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Roy H. Forbes, "Rural Education and the Reform Movement," Education Digest, 55, (5), (January, 1990): 23-26.

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"Distance Learning by Interactive Video Technology," p. 7.

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"Using the Telephone to Expand the Classroom: A Guide to Teacher and Classroom Telephony," Northern Telecom, Publication No. ES 9102, (March, 1991): p. 9.

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TABLE A

Distance Learning Classroom Equipment

12	27" color video monitors	@ 700	$ 8,400
6	monitor brackets	@ 200	1,200
6	3" yoke pipes	@ 24	144
1	T42E cart with 5" casters		150
2	VTR20E 32" cart	@ 100	200
2	Winsted mini-frame	@ 144	288
6	flat monitor shelf	@ 83	498
2	frame extensions	@ 122	244
3	Panasonic D5000 video camera	@1,500	4,500
2	Panasonic WV CR12 controller	@ 345	690
1	Panasonic 10H-50AS 50' camera signal cable		115
2	Panasonic 10H-30AS 30' camera signal cable		114
2	Panasonic WV CA10 cable	@ 29	58
3	Panasonic WV 3203 power supply	@ 100	300
1	VCLO.5 for WVLZ14 8AF lens	@ 150	150
1	tripod with dolly		305
2	ceiling camera mount	@ 80	160
1	Panasonic active switcher WJ 220B		250
1	1/2" VHS VCR		350
1	Shure M67 microphone mixer		387
1	Crown sound grabber PZM microphone	@ 88	528
1	Shure SM 11CN microphone		90
	Miscellaneous cable, connectors, power & surge strips		600
TOTAL: (This figure varies according to vendor.)			$15,685 - $19,551

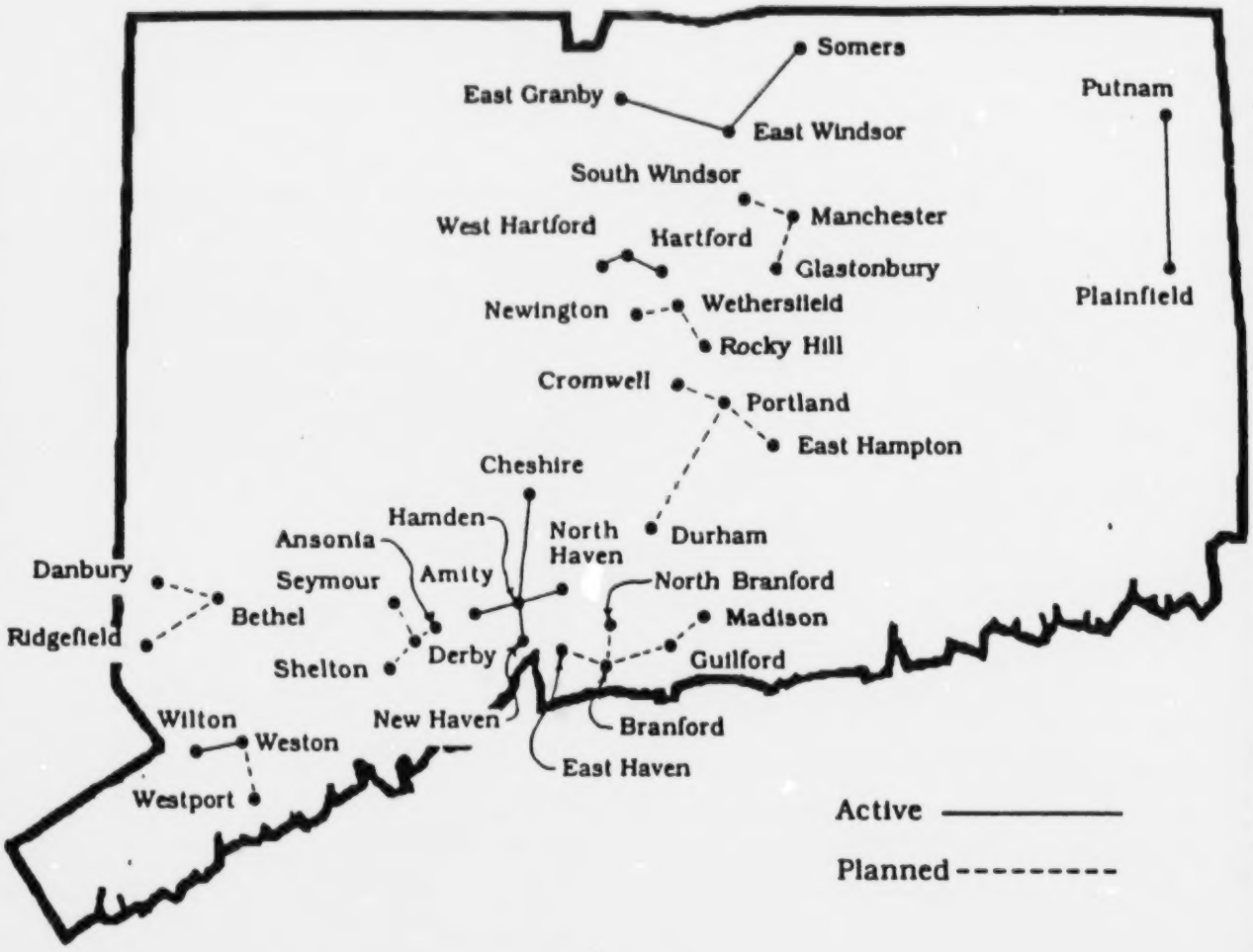
Additional equipment requirements include outside telephone line and telephone into the distance learning classroom, computers specific to offered course, printer, and modem (depending on offered course).

Equipment can be purchased over a period of time

Year 1	Minimum receiving site	$5,375
Year 2	Full receiving site	$4,425
Year 3	Minimum origination site	$4,890
Year 4	Full origination site	$ 995

Source: Valley Shore Telecommunications Cooperative, 1991.

TABLE B



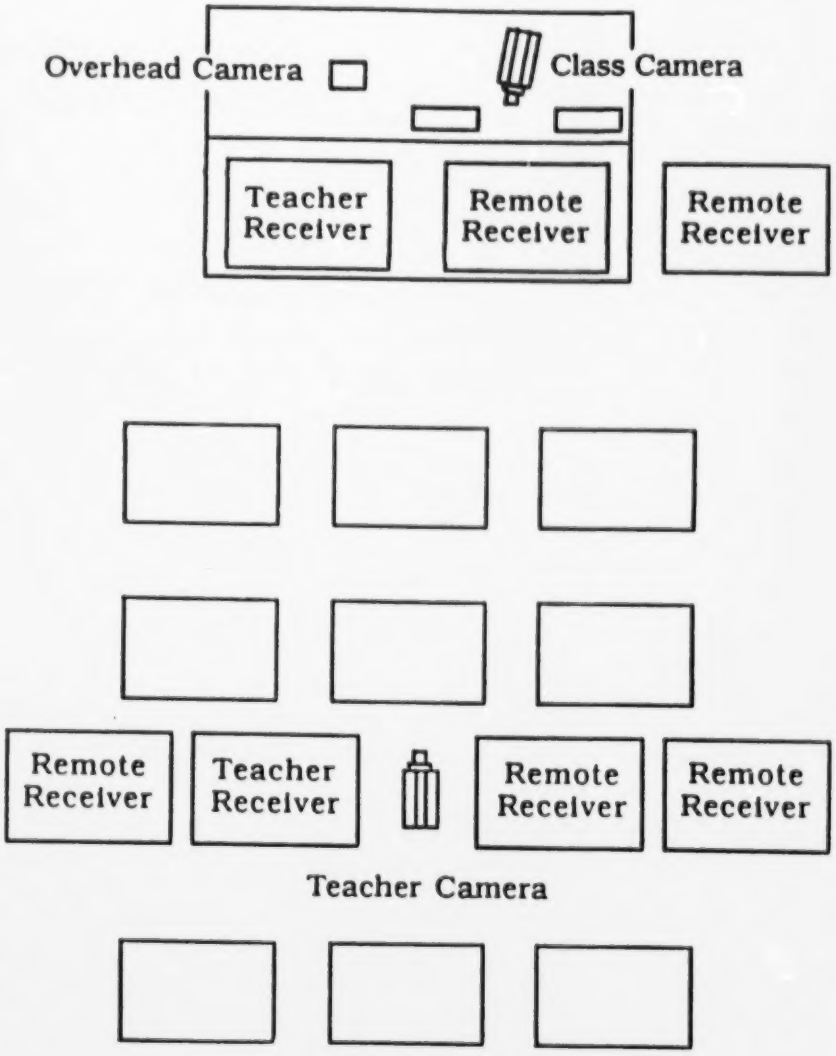
Distance Learning Projects in Connecticut

WBM 6/89
11-37

Source: Middlesex Distance Learning Consortium

TABLE C

Distance Learning Classroom



WBM

Source: Middlesex Distance Learning Consortium